Balanced Floating Piston Valve for Ultra-High Pressure, High-Volume Liquid and Gaseous Flow Control, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

C-Suite Services, LLC (C-Suite) will produce at least one manufacture-ready, full-scale design for the licensed technology of the Balanced Floating Piston Valve. This design is intended as a "drop-in" replacement for an existing valve used in rocket engine component testing. The operating environment, pressures to 15,000 psi and flow rates of 1,000 lbm/sec of Gaseous Nitrogen, have proved problematic for the existing valve designs. High cost of repairs and limited life has resulted in an increase in cost for testing.

C-Suite is the NASA licensee of the valve, which was designed to resolve the issues created by the high pressure, flow, and acoustic vibration environment at NASA Stennis Space Center (SSC) rocket engine test stands.. This innovative design eliminates the valve stem and stem seals, as well as the need for conventional actuators, which are the frequent source of failures and fugitive, often toxic propellant emissions. The innovative valve is called "Floating Piston Valve" (FPV); it does not have any moving parts that are connected to the atmosphere and no adjustments are required. The flow path through the valve is all 100% axisymmetric, meaning that the forces generated by the flow through the valve create only radial forces that cancel, or create axial forces that either cancel or are controllable. The FPV's internal piston is balanced such that the seating force is immune to the pressure drop across the valve greatly improving seat wear and providing much longer, useful life without maintenance and refurbishment interruptions. The FPV is simpler to manufacture (5 parts vs. hundreds of parts for comparable ball valves) and is expected to have far greater utility (600+ duty cycles vs. 20-30 duty cycles for comparable ball valves). Finally, because there are no moving parts connected to the atmosphere, it will eliminate fugitive emissions, many of which are toxic and waste costly propellant chemicals.

Anticipated Benefits

The Floating Piston Valve (FPV) will replace the large ball valves used to control ultra-high pressure and high-volume flows of propellants and gaseous nitrogen at rocket engine ground test stands. Benefits of the FPV include (a) much longer onstream time, (b) lower total capital costs, (c) less expensive, faster refurbishment turnarounds, and (d) longer life between repairs. The reduced downtime will drastically reduce expensive opportunity cost penalties associated with test delays.

The FPV has already proven successful as a superior pilot operated relief valve for a manufacturer of CNG and H2 tube trailers; additional high pressure uses for ultra-high pressure, high-volume propellant flow control for the private spacecraft industry, pressure relief devices for CNG-powered vehicles, remotely operated, reliable supercritical carbon dioxide (sCO_2) pipelines, and certain high-pressure applications in chemical, petrochemical and oil refinery operations.

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Small Business Innovation Research/Small Business Tech Transfer

Balanced Floating Piston Valve for Ultra-High Pressure, High-Volume Liquid and Gaseous Flow Control, Phase I

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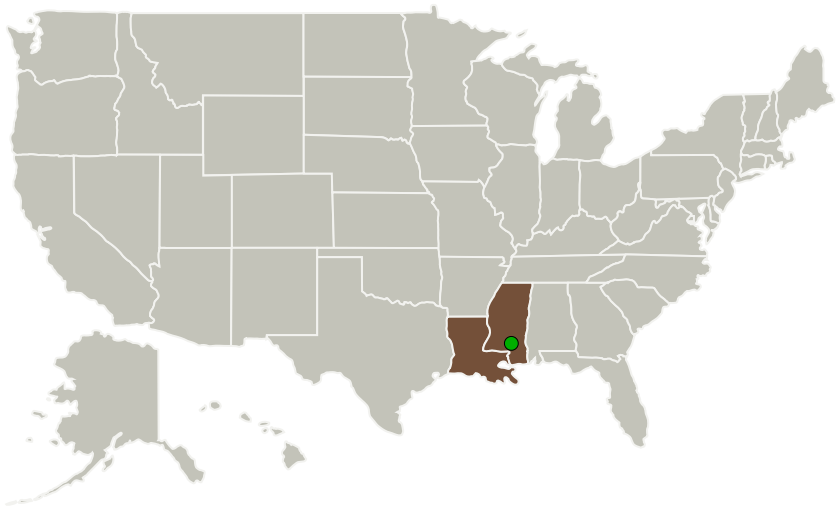
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
C-Suite Services, LLC	Lead Organization	Industry	Metairie, Louisiana
Stennis Space Center(SSC)	Supporting Organization	NASA Center	Stennis Space Center, Mississippi

Primary U.S. Work Locations	
Louisiana	Mississippi

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140948)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

C-Suite Services, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

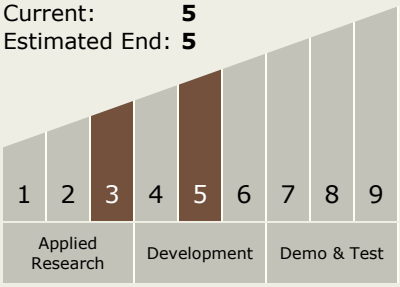
Carlos Torrez

Principal Investigator:

Kevin Pollard

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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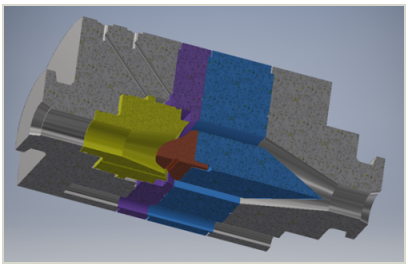
Images

Briefing Chart Image
Balanced Floating Piston Valve for Ultra-High Pressure, High-Volume Liquid and Gaseous Flow Control, Phase I
(https://techport.nasa.gov/image/130233)



Final Summary Chart Image
Balanced Floating Piston Valve for Ultra-High Pressure, High-Volume Liquid and Gaseous Flow Control, Phase I
(https://techport.nasa.gov/image/130348)

Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
  - TX13.1 Infrastructure Optimization
    - TX13.1.1 Natural and Induced Environment Characterization and Mitigation

Target Destination

Earth